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ABSTRACT

The two information fact sheets describe (1) available computer options for use with a handicapped individual and (2) available communication techniques or aids for a severely physically handicapped son or daughter. The first fact sheet considers three ways a physically disabled individual can use a microcomputer: using special software designed to run on standard computers; modifying the system software in the computer to allow the handicapped to use standard software; and using hardware adaptations or devices to allow the handicapped to manipulate standard software. Special software includes text-to-braille translation, talking systems, and enlarged print. Modification of system software focuses on changes in operating system instructions. Hardware adaptations include simple modifications to the keyboard; the connection of special alternate keyboards, disk drives, or displays; approaches to the acceleration of input rate; and alternate approaches to visual display information for blind individuals. The second fact sheet looks at the role of communication aids in conversation/interaction and in writing. The importance of communication rate (speed factors) in selecting any communication system is stressed. Evaluation services and additional information sources are listed. (DB)

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Commonly Asked Questions [Computers]

and

CAQ-#1 (Revised October 1986)

Trace Research and Development Center
on Communication, Control & Access for Handicapped Individuals
Waisman Center
University of Wisconsin-Madison

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COMMONLY ASKED QUESTIONS

SEPTEMBER, 1986

Q: I AM INTERESTED IN USING A COMPUTER WITH A HANDICAPPED INDIVIDUAL, AND WOULD LIKE TO KNOW WHAT IS AVAILABLE.

First, it is important to know what it is that you would like the computer to do. A microcomputer can be used in many different ways to assist disabled persons. It can be used to help meet communication needs such as conversation and writing; it can be used to assist in education, recreation, independent living, and mobility. In some cases, it is used to provide new techniques for education or recreation. In other applications, computers can provide a disabled individual with a different way of accomplishing tasks non-disabled individuals normally accomplish without a computer. For example, for many people with disabilities, the lack of an effective mechanism for writing or communicating conversationally presents a serious barrier to meaningful opportunities for education, employment, personal development, or creativity.

Finally, disabled individuals will need to operate computers for the same reasons that everybody else uses computers: that is, disabled individuals will need to be able to operate the computers and run the standard software programs that they find in their schools, homes, and business. This last need means that disabled individuals need to be able to use computers not just with special programs written for them, but also with all of the standard software programs written for non-disabled individuals.

The type of disability and the specific problems these disabilities present are also important in discussing what is available. Physically disabled individuals, for example, primarily have difficulty with the input to and control of computers and software. They may also have difficulty handling disks and other materials that they use with the computer. Sensorially disabled individuals, especially the visually impaired, experience difficulty in getting information from the computer. Most of the output and feedback from a computer today is through the monitor screen. For individuals who have difficulty in seeing the screen, or who are completely unable to see the screen, alternate display methods may be required. People who have language disorders, such as aphasia, or who have learning disabilities, may be able to benefit from alternate input and output displays, but primarily need assistance in message formulation, perception, and other areas, which are still in great need of research.

In general, there are currently three ways that a physically disabled individual can use a microcomputer:

1) Using SPECIAL Software Designed to Run On Standard Computers

2) Modification of the System Software in the Computer to Allow Handicapped Individuals to Use STANDARD Software

3) The Use of Hardware Adaptations or Devices to Allow Handicapped Individuals to Use STANDARD Software

1) Using SPECIAL Software Designed to Run on Standard Computers

There is a wide range of custom software programs that have been written or adapted for use by physically handicapped individuals. Some of these programs require as little as one switch to operate them. These programs include: communication and writing programs, motor training games, educational software, therapy and assessment programs.

For blind and visually impaired individuals, there are programs that provide text-to-braille and braille-to-text translation; talking systems for word processing, data processing, database management, etc.; enlarged print, enlarged graphics; information managers such as talking phone directories, address lists, and calendars; and automatic form writers to permit completion of standard forms.

These programs run on the standard computer with little or no modification, other than the addition of special input, a speech synthesizer, braille printer, etc. Programs in this category do not permit the use of the alternate input or display techniques with other standard software programs, however.

2) Modification of the System Software in the Computer to Allow Handicapped Individuals to Use STANDARD Software

This approach involves changing the operating system of the computer. The operating system is a part of the computer (software) which most programs use to get keystrokes from the keyboard or to print things on the screen. Changes can be made in the operating system's instructions so that programs asking for input from the keyboard will also be given "keystrokes" that come from special interfaces for disabled persons.

Changes can also be made in the operating system instructions so that programs sending output to the screen will also send those characters to a speech synthesizer or braille display. Programs are available that allow synthesized speech output of the characters and spaces under the cursor as it moves forward, backward, up, or down, using cursor control keys. Upper and lower case letters, punctuation, special characters, and the state of various key (e.g., "CAP LOCK") can be identified. Any line can be read or spelled out.

Unfortunately, there are many pieces of software that do not use the computer's operating system to access the keyboard or TV screen. This is done most often in order to speed up the software, or add special features. As a result, the "modification to system software" approach provides only a partial solution, and will work only with an unpredictable portion of the software for any given microcomputer. At the present time, no system software modifications have been identified that will work 100% of the time. There are some, however, which work for most software programs. In addition, future operating systems will make this approach more and more workable.

3) The Use of Hardware Adaptations or Devices to Allow Handicapped Individuals to Use STANDARD Software

At the present time, about the only way to guarantee that a handicapped individual will be able to use all standard software for a computer is to use a hardware modification of some type. These modifications can be implemented in such a way

that the computer cannot tell that the disabled person is not using the computer in a standard, unmodified way. Because the computer cannot tell that these modifications are in place, they are termed "transparent" modifications. A fully transparent modification will allow a disabled individual access to ALL STANDARD SOFTWARE. Further, it will not interfere at all with the operation of the computer or the software.

There are two major types of transparent modifications: a) simple modifications to the keyboard, disk drives, or TV monitor, and b) connection of special alternate keyboards, disk drives, or alternate displays.

A) Simple Modifications to the Keyboard to Facilitate Their Use by Disabled Individuals

The most common modification for physically disabled persons involves the use of keyguards and key latches. Keyguards are essentially plates that fit above the standard keyboard, and have holes over each key. The disabled person can then lean on the keyguard to stabilize his hand motions and poke a finger (or stylus, mouthstick, headstick, etc.) down through the holes to operate the keys.

Key latches are used to allow the disabled individual who is using a single finger (stylus, headstick, etc.) to handle the shift and control keys. Since the individual is using only one finger, it is not possible to hold down the shift or control key and press another key at the same time. Key latch mechanisms fit over the shift keys (also the control, alternate, and other similar keys) and hold these keys down for the individual so that he can type other keys while the keys are held down. Most keyguards have latches built into them. In addition, there are some latches available for individuals who have only one hand or use only one finger, but do not need keyguards. (There are also software key latching programs which work with most standard software.)

B) Connection of Special Alternate Keyboards, Disk Drives, or Displays

For individuals unable to use the standard keyboard, other specialized input devices have been developed. Optical lightbeam pointers can be used to select items displayed on a communication aid, or to select from a "keyboard" displayed on the TV screen. Keyboards that allow the individual to "type" by looking at "keys" on the eye gaze keyboard have also been announced recently for individuals who can hold their head still. Large expanded keyboards are available for those who lack fine motor control, and miniature keyboards are available for those who have limited range of motion. Approaches are also available that allow individuals using a single switch or joystick to operate the computer. Another promising new field for physically disabled individuals is voice input speech recognition devices. Voice input interfaces are available, although their use and vocabulary size is currently limited.

All of these alternate techniques use a concept called keyboard emulation in order to allow the disabled individual to use all of the standard software. A keyboard emulator is simply a device that creates exactly the same signals as the standard keyboard. As a result, the input form keyboard emulators look identical to that from standard keyboards as far as the computer is concerned. Any software that will run with the standard keyboard will therefore run with the keyboard emulator. In addition, the keyboard emulators are designed so that the standard computer keyboard remains connected, even while the emulators are being used. As a result, connecting a keyboard emulator to the computer does not restrict the use of the computer by able-bodied individuals in any way. The computer continues to function exactly as normal

for standard computer users.

The keyboard emulation function is sometimes built directly into the specialized communication aid or interface; in this case, the special or alternate keyboard can be used directly with the computer.

In other cases, a special adaptor or keyboard emulating interface is used to allow a communication aid to be used as an alternate keyboard. These keyboard emulating interfaces are connected between the computer's standard keyboard and the computer. Any other communication aid or device that puts out ASCII characters can then be used instead of the computer's standard keyboard. (A software keyboard emulating interface for the IBM PC is also currently under development.)

Use of a keyboard emulator does not affect the normal use of the computer in any way. The normal computer keyboard remains active and functional at all times, whether the keyboard emulator is being used or not. Thus, installation of a keyboard emulator in a computer allows access to the computer by handicapped individuals using special aids, but does not in any way change the function of the computer for non-handicapped users.

C) Acceleration Techniques

In addition to the special input techniques, other adaptations are being developed to increase the rate of input for individuals who have disabilities. Specialized abbreviation expansion routines, word prediction routines, and other techniques to allow whole words, phrases, and sentences to be communicated using a small number of keystrokes are becoming available.

D) Visually Impaired Individuals

Alternate approaches to visual display information are necessary for blind individuals and those who have visual acuity impairments. Devices that provide enlarged images, voice output, and braille output are available. Just as there were three alternate approaches to allowing access to computers for people with physical disabilities, these same general approaches can be described for those with visual impairments. Simple modifications for visually impaired individuals include the use of large magnifying lenses placed in front of the TV monitor, and the use of over-sized TV monitors to increase the display size. More advanced electronic systems for visually impaired individuals also exist. For individuals with low vision, there are systems that provide electronically expanded displays of the computer display. The characters can be enlarged, in stages, up to a point where only one or two letters will fit on the entire TV screen. For totally blind individuals, systems are available that tap into the computer's memory where the TV screen's contents are stored. This information can then be fed out to braille displays or to voice synthesizers to allow blind individuals to "read" the TV display. Devices are also available that, using a tiny hand-held camera, allow an individual to scan the CRT screen with the camera in one hand, and have a tactile representation of the scanned image appear on the fingertip of the other hand.

SUMMARY

As you can see, there is a wide range of SPECIAL SOFTWARE that has been developed for disabled individuals, as well as special adaptations and devices to allow access and use of STANDARD SOFTWARE. There is a very definite limit, however, to what computers can do today based upon the programs and adaptations available

for them. In trying to determine whether a computer will help a given individual, it is important to first know exactly what it is that you would like the computer to do for the individual. You can then see whether a computer program or adaptation is available that is designed to do this. Detailed summaries on different aspects of existing hardware and software developments for disabled individuals are available from a number of sources. A good place to start is Book 3 of the Rehab/Education Technology Resource Book Series, Software and Hardware available from the Trace Center (see below). Complete information on all of the developments discussed in this write-up, as well as on many other adaptations, may be found there.

A wide variety of newsletters, organizations, etc. with valuable information about this area are listed in the Trace Quick Sheets. Some of the other information sources in this field include:

Reprint Service (ask for an Information Available Brochure)
Trace Research & Development Center
S151 Waisman Center
1500 Highland Avenue
Madison, WI 53705

Closing the Gap
(a newspaper on computer use by disabled persons)
Budd Hagen, Ed.
P. O. Box 68
Henderson, MN 56044

Link and Go
(includes COPH Bulletin)
Congress on the physically Handicapped
2030 Irving Park Road
Chicago, IL 60618

Raised Dot Computing Newsletter
Raised Dot Computing
408 South Baldwin
Madison, WI 53703

Communication Outlook
Artificial Language Laboratory
Michigan State University
405 Computer Center
East Lansing, MI 48824-1042

We have included with this letter any resource lists that pertain to your specific question. Once you have had a chance to read over this material and contact some of the other suggested resources for more detailed information on their products, please feel free to write or phone us with further questions.

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CAQ-#1

Revised October 1986

Q: I HAVE A SEVERELY PHYSICALLY HANDICAPPED SON/DAUGHTER. WHAT KIND OF COMMUNICATION TECHNIQUES OR AIDS ARE AVAILABLE?

In answering this question, you should be aware that there are two basic areas with which your child may need help:

1) Conversation/interaction
2) Writing

Communication

The communication need that we think of first is conversation/interaction. A basic problem is that many individuals are not able to use speech for communication and interaction. As a result, we need to look toward some augmentative or supplemental technique to help him/her with communication. In some cases, they may not be able to speak, but may be able to communicate regarding some topics in some environments with some people at some times. However, unless the person is able to communicate and be understood at all times, some type of supplemental technique is indicated.

In general, an augmentative aid is necessary unless the individual can communicate about all topics with all people. The augmentative aid would not replace his/her residual speech, but would simply back it up. When the individual could speak, he/she would use that mode (or any other mode that was most efficient). When he/she was unable to communicate through his/her other means, he/she would turn to the back-up or augmentative system to communicate.

There is a wide variety of specific techniques which can be used for communication. All of these techniques can be implemented in one form or another without the use of electronic aids. Printing to words or symbols on a communication board is one example. There are also techniques which can be used by an individual who is so severely involved that he/she is barely able to move an eye in one direction, and has no other volitional body movements at all. These techniques, all of which can be implemented without any technology, can provide even the most severely physically involved individual with a mechanism for communicating. For individuals who can spell, the techniques can allow the individual to spell out exact messages, to write letters, etc. These unaided techniques, however, require the presence of a second person to interpret signals.

Communication aids are also available. These aids are essentially automated versions of the fundamental (non-technical) techniques described above. The primary advantage of aids is that they allow the individual to assemble messages

independently. While not as essential for conversation and interaction (since a second person is there by definition in conversation), these aids can be very important for providing the individual with a means of doing independent work and writing.

Writing

The second area of need is writing. Essential to any educational process is the ability to write and do independent work, take notes, do homework, and complete assignments. We would not think of sending a normal individual to school without pencil and paper; nor would we allow them to go to school without doing their homework. It would be very difficult if not impossible for them to receive a full and adequate education. For those individuals who have the ability to recognize words and learn to spell, some type of writing system will be needed.

When choosing a communication aid, it should be remembered that the need for aids stems from their ability to be used independently. The primary need for this independence is in messaging and writing. For conversation, the fundamental and unaided techniques are usually faster and more flexible. When looking at independent aids, the writing needs must be considered very carefully, and should weigh heavily in the selection process.

Rate

A key factor that you will want to consider when selecting conversation or writing systems is the rate of communication. The various techniques (whether aided or unaided) each require different abilities from the handicapped user, and have different efficiencies or speed factors. Some techniques can be used by only a small portion of the handicapped population, but are faster. Other techniques can be used by anyone, but are generally slow (for example, scanning techniques). Thus the problem is not finding a technique which an individual can use, but rather finding the technique which will allow a given individual to communicate more rapidly. It is not uncommon for different techniques to vary in their communication rates by a factor of as much as ten to one. Thus, what would take one minute to communicate using one aid might take ten minutes to communicate on another; and what would take five minutes on one aid might take almost an hour on another. Since there are many specific techniques and aids as well as variations on their application, it is not a simple task to find the best aid for a given individual. For this reason, it is usually best to involve someone with special training and an in-depth knowledge of all of the various techniques and approaches, especially the newer ones, when making a selection for a more expensive aid.

This problem is compounded by the fact that there are many therapy and training techniques which can greatly enhance the physical abilities which a given child (or adult) is able to exhibit. Someone familiar with and trained in these specific strategies may be able to interface a child to a much faster aid than a person less familiar with these strategies. Because the field is so new, there is a severe shortage of these specially trained individuals at the present time. Efforts are being made to document these specific strategies and make them available to individuals through special training materials and programs.

Information Sources

In the meantime, you may want to invest some time in learning about the various techniques and approaches yourself. This will assist you in your interactions with

professional teams. The first recommendation is that you subscribe to Communication Outlook. This very application-oriented newsletter will provide you with a window on all of the latest developments in this field. This includes information on new aids as well as new books and publications which come out in this area. In addition to subscribing to the newsletter, you may want to also secure copies of their back issues, since there are many things which have already occurred which you may want to be aware of, but would otherwise be difficult to find. Subscription information for Communication Outlook is enclosed.

For general introductory information on the various techniques, you might look at Rehab/Education Technology ResourceBook Series, Book 1: Communication Aids, and/or several chapters in the book by Richard Schiefelbusch, Non-Speech Language Intervention Strategies. Both of these books contain overviews of the basic approaches as well as specific information on symbol systems and the design of fundamental communication boards. The Rehab/Education Technology ResourceBook Series is available directly from the Trace Center or from the publisher; the Schiefelbusch book can be secured from the publisher, University Park Press in Baltimore, Maryland.

For a listing of all of the existing commercially available aids, the only comprehensive source available is the Rehab/Education Technology ResourceBook Series, Book 1: Communication Aids. This contains descriptions, including photographs, of all of the aids which are available in this area. The Resource Book is available either from the Trace Center or from College Hill Press, the publisher.

Information on the three books in the ResourceBook Series is given on the Information Available brochure.

Also listed are a number of other publications and papers which are available from the Trace Center. Descriptive information is provided with each title to give you some guidance with regard to their relevance to your particular concerns.

Evaluation Service

If recommendations for a specific individual are desired, there is a special evaluation clinic at the University of Wisconsin Hospital and Clinics. The Communication Aids and Systems Clinic is a separate but integrally connected program with the Trace Research and Development Center. Evaluation staff in the Clinic are also on the staff of the Trace Research and Development Center. This provides a unique capability for evaluation of clients both in terms of that which is currently available and in terms of new and developing approaches.

The Clinic is staffed by a team which includes individuals with expertise in speech and language pathology, adaptive seating and positioning, low and high technologies, microcomputers, augmentative conversation and writing systems, and techniques to permit to access to computer and word processing systems.

The Clinic accepts clients on both inpatient and outpatient basis. Outpatient evaluations take approximately one day, except where extensive seating and positioning modifications are required to optimize the individual's physical control.

For more information on the Clinic, please contact:

Ms. Donna DePape, M.S., CCC-Sp.
Communication Aids and Systems Clinic
S120 Waisman Center
1500 Highland Avenue
Madison, WI 53705
(608) 263-7726

Further Information

If you received this write-up from the Trace Center - you should also find an Information Available from the Trace Center Reprint Service brochure. This brochure and Communication Outlook are two good sources for further information in this area. If you received this write-up via the grapevine, you can get copies of the Information Available from the Trace Center brochure by writing to:

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Communication, Control, and Computer Access for
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S151 Waisman Center
1500 Highland Avenue
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